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EYESIGHT IN RELATION TO COMPENSATION.

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THERE is an obvious, although at times little realized, connexion between all phases of the healing art and economic science. Vital statistics, giving as they do valuable information regarding the population of a district or country, are of immense importance to the political economist, for on the population of a country its power of material production largely depends. This dependence of economics on medicine, especially on that branch of it which is known as public health, meets the economist at many points which need not be elaborated in this paper. Two familiar examples will illustrate my meaning. The advance of medical science has appreciably increased the expectancy of life, at any rate in civilized countries. Owing to the efforts of public-health authorities, and probably, also, to the improvements which have taken place in surgical practice, the average of human life is now greater than it was only a few years ago. People, as a rule, live longer.

One of the effects of this on economic science is that the actuarial tables used, say, fifty years ago by companies doing life assurance business, are now found to be more or less obsolete. On the other hand, statistics may help to determine the line of treatment to be pursued by the physician or surgeon in a given case. We know, for example, from a study of comparative death-rates, that the treatment of diphtheria by antidiphtheritic serum is much better than any other line of treatment hitherto adopted.

All departments of medicine are of a certain economic importance to the community, and the connexion between economics and ophthalmic science has become much more obvious of recent years, at least so far as the United Kingdom is concerned, by the enactment of laws regarding workmen's compensation.

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Several authorities both in the United Kingdom and in various parts of the Continent of Europe have made endeavours to derive formulae with which to assess the damages due for the loss or for the partial impairment of one eye. To my mind the question can only be decided by the observation of a large enough number of cases and the collection of sufficient data. But even when a sufficiency of observations has been made it seems to me extremely doubtful if any rule or formula can possibly be derived. Having been engaged for some years in the examination of persons suffering from injuries to the eye I naturally became anxious to determine what amount of injury to the eyesight prevented a man from doing ordinary work. For that purpose I began to gather together information about men possessed of only one eye and who, in many cases, were not entitled to compensation under the recent legislation on account of their having lost the eye either from disease or previous to the passing of the recent enactments.

The statements which are made in the witness-box are often wild in the extreme. Quite recently in a case in one of the Scottish courts, two of the medical witnesses for the injured man stated that it was quite impossible for a man with only one eye to wheel a barrow, and oddly enough the judge took that as being an ascertained fact. Any one who tries will find that it is quite easy to wheel a barrow along a plank with one eye shut; the evidence was totally erroneous. Another statement which is often made is that after the loss of an eye a patient is unable to wield a hammer with useful accuracy because it is said that his intuitive perception of the third dimension of space is destroyed. As a matter of fact, if a person shuts an eye and uses only one, he will find that he can handle a hammer practically as well in that condition as with both eyes. The question here is not the distances of several points relatively to each other, it is chiefly a matter of alignment and of the absolute distance of the object to be struck from the person who intends to strike it.

For the purposes of this paper I have taken 20 cases from my own clinic, and these show that men are often able to work at the most difficult and hazardous occupations with only one eye, or with defective vision in both. The first two are so exceptional that I wish to give them special prominence.

1. J. McE., aged 30, has been employed all his life as a collier. During the last three years he has been engaged in the same pit as a holer. In both eyes there is marked retinitis pigmentosa, which is tolerably far advanced. With either eye he can count fingers at a foot, but not beyond that distance. He says that the wages he has earned have been nearly the same as those made by other men in the same part of the pit, although perhaps he has been a little under the average.

2. The second case is also one of retinitis pigmentosa. I last saw this patient on July 14th, 1905, but had, on account of his malady, seen him from time to time for some years preceding. During my attendance on him I extracted a cataract from his left eye. On the day before mentioned I found an incipient cataract in the right eye, which diminished its vision to $\frac{5}{6}$ of

Snellen's scale ; with this amount of sight he was actively engaged below ground. At his work he wore no correction on the side which had undergone the operation

3 The third case is that of P. S , who was seen by me at the Eye Infirmary, Glasgow, on November 28th, 1905. Eighteen years previously the right eye was injured, and two years thereafter it was enucleated. The vision of the remaining eye was found to be $\frac{6}{12}$ Snellen, and the field was much contracted. This man has throughout the eighteen years that have elapsed since he sustained the injury been actively employed as a stevedore's labourer, and has been largely engaged working at the end of a gangway.

4. The fourth case is that of an iron turner. J. McA., aged 45, lost the sight of his left eye when he was 33 years old by an injury from a chip of steel. Ever since he has had to depend on his right eye and states that he has made as good wages as any one similarly employed. The visual acuteness of the left eye is $\frac{6}{12}$ Snellen, and the field is not materially contracted

5. W. B , seen by me at the Eye Infirmary, Glasgow, in 1905, lost the right eye in 1888. He has, however, been able to continue at his trade of boilermaking ever since. The vision of the uninjured eye is $\frac{6}{9}$ Snellen, but the field for white is much contracted.

6. D C., aged 53, was examined by me at the Eye Infirmary in 1905. This man lost his left eye about forty years ago while serving his apprenticeship as a boilermaker. Ever since he has continued at his work, but recently has experienced great difficulty in reading figures on drawings. In the right eye there is a manifest hypermetropia of 1.5 D, and when this is corrected his vision is $\frac{6}{6}$. The lens of the right eye is somewhat muddy and the disc is hyperaemic ; he smokes heavily but there is no colour scotoma. Apart from the difficulty of reading the figures he says he is fit for all the work of a boilermaker.

7. R. L , aged 40. Four years before I saw him the left eye had to be removed for injury by a piece of metal. Ever since he has continued at his work as a blacksmith without suffering any appreciable inconvenience. The vision of the right is $\frac{6}{9}$ Snellen, and the field is not contracted.

8 J. M , aged about 40 The left eye was hurt by a piece of steel about twelve years before I saw him at the hospital in 1905 There is old-standing iritis and cyclitis, with complete posterior synechia. Ever since the accident he has been able to continue his work, using his right eye alone, the vision of which is $\frac{6}{9}$ Snellen.

9. R S , aged 48 This patient completely lost the sight of the left eye twenty-two years before I saw him at the Eye Infirmary in 1905. Ever since he has worked as an engine fitter with the right eye alone, and has earned as good wages as any one else. The vision of the remaining eye is $\frac{6}{12}$ Snellen.

10. J. B., admitted to the hospital on April 25th, 1905. The left eye was injured twenty-four years ago. The damaged organ is of normal size ; a cicatrix is seen at the upper part of the cornea, extending to the ciliary region, and the eye is quite blind. At the time of my examination he was working as a hole-borer and was earning full wages. The vision of the right eye, the one used for work, is fingers at a metre, but not at a greater distance. The defect in its sight is due to incipient cataract.

11. T. F., aged 53, was seen by me at the hospital on September 5th, 1905. This man's right eye was injured by a chip of metal seventeen years previously. There is found to be a dense white cicatrix of the cornea to which the iris is adherent. The vision of his left eye is $\frac{6}{12}$ Snellen, but his earning power has been quite good during all these years.

12. R. R., aged 59, was seen at the Eye Infirmary in 1905. This patient has been working all his life as a country blacksmith till within a few weeks of his visit to the infirmary. He has had to desist, not on account of his eyesight but because of stiffness in one of his legs, which makes it difficult for him to continue his work as a farrier. The vision of the right eye is less than $\frac{6}{60}$ and that of the left is $\frac{6}{60}$ Snellen. Yet he says that, so far as eyesight is concerned, he has not had the least difficulty in shoeing horses. There is a hypermetropia of 3·5 in each eye, and there is a nebula on the cornea of the left eye.

Most of the cases hitherto cited have been ironworkers; the rest of this communication is largely devoted to miners who have carried on their work with defective sight.

13. E. McW., seen at the Eye Infirmary in August, 1905. The right eye was lost by injury in the year 1901. For three years afterwards he was employed as a fireman, but for the last year he has been working as an ordinary collier. His vision in the remaining eye is only $\frac{6}{60}$ Snellen.

14. J. K., aged 47, lost the sight of the right eye when a baby, probably from ophthalmia neonatorum. There is a large leucoma occupying about a third of the left cornea to which the iris adheres, and the vision as tested by Snellen's illiterate types is $\frac{6}{60}$. He is occupied as a drawer and states that he has always earned as good wages as any man engaged at similar work in the same employment. He has on several occasions used a hammer to drive stobs and has often wheeled a barrow without finding any difficulty.

15. J. J., aged 42. Five years ago by the onset of cataract this patient lost the form sense of the left eye entirely. At the time this happened he was employed as an ordinary miner and his earnings were not diminished. Since that time he has been promoted to the post of overman, and is able for all the duties of that station. The visual acuteness of the remaining eye is $\frac{6}{5}$, and with cyl. −2.5, axis nearly vertical, it amounts to $\frac{6}{4}$.

16. J. McG., aged 58, lost the sight of the left eye when 13 years of age by injury from a stone. On examining him, I found a dense leucoma, with adherent iris at the inner aspect of the cornea, which reduced the vision of the eye to the perception of light. The acuteness of the remaining eye was $\frac{6}{4}$ Snellen. For a number of years he has been engaged repairing roads and shafts, and has earned as much as any other man similarly employed in the pit. In the useful eye there is a hypermetropia of 2 D, and when this is corrected the vision is $\frac{6}{5}$.

17. T. S., aged 34, lost the sight of the right eye thirteen years before I saw him. The injured eye was removed a fortnight after the accident. He has always worked as a brusher, and is at present earning as such full wages. He constantly uses a hammer for wedging material while repairing roads, and has never had any difficulty with it.

18. T. D., aged 57, is in full employment as a miner. His right eye was injured four years ago, and is now quite blind. The vision of the left is $\frac{6}{5}$ Snellen, but he has not found his earning power at all diminished by the accident, and can use either a pick or a hammer quite freely.

19. G. H., aged 60, has been a collier all his life, and is still employed as such, working full time. The right eye was injured twenty years ago, and is now completely atrophied. The vision of the other is $\frac{6}{5}$ Snellen. His earning power has undergone no diminution, and he can wheel a barrow along a plank and use a hammer quite freely. Recently he erected a paling round his garden and drove the stobs himself.

20. S. M., aged 23, ironstone drawer. Some years ago this patient's left eye was removed for injuries due to the kick of a horse. The vision of the remaining eye is $\frac{6}{9}$ Snellen. He has often to use a hammer in breaking up lumps, and has never experieneed any difficulty in so doing; his earning power has not been diminished by the accident.

Such examples might be multiplied indefinitely; they open up a wide field for speculative thought, into which I do not mean to enter. There are, however, one or two practical aspects of the question which may properly receive some attention here. And first it is to be noted that a good deal is likely to depend on what may be called the patient's resource. No one would be justified in certifying, for example, that the men suffering from retinitis pigmentosa were fit to work at the face of a coal pit.

Yet here they are both actively engaged below ground. This factor varies considerably in different individuals, and is a thing which cannot be expressed by any formula. Consequently, any attempt to establish a definite relation between a person's wage earning capacity and his eyesight seems to me to be hopelessly futile. I know of one blind man who can get about the streets with very great ease, and another who can scarcely find his way to a house round the corner of the street from his own door. Individual differences in this element are probably very great.

Another element equally impossible of evaluation is the injured man's truthfulness. The only means which we have of measuring a person's visual acuteness is by letters, or by other objects of known size. But when a patient is placed in front of letters which gradually diminish in size we have no means of testing whether the smallest letters which he reads are the smallest which he sees. He may only read $\frac{6}{36}$, while all the time his vision is $\frac{6}{9}$. There is obviously a great temptation placed before frail humanity if the worse the vision the greater the compensation. Frequently a witness goes into the box and states on oath that the vision of the injured man is, say, $\frac{6}{36}$. What he really should say is that at the examination the patient read letters of $\frac{6}{36}$, but as to whether that is his best or not he (the witness) is entirely ignorant—unless, indeed, when he has during the examination found something which would account for such a diminution of the acuteness, Here, therefore, we have another factor which must falsify any formula which attempts to express a relation between wage earning capacity and the form sense.

Lastly, and most important of all, there are many kinds of employment in which the form sense does not seem to play any appreciable part; several of the cases just described are excellent examples of this. To these we may add all persons who have an excessively high degree of myopia. One instance will suffice to illustrate my meaning, and will recall to every ophthalmic surgeon's memory similar cases which he has seen in his practice. A young man had worked for several years in a coal pit. He thought he would try to get employment above ground,

and accordingly applied to a railway company, but was rejected on account of his sight. He came to the hospital, and then I found that he had a myopia of 10 D in one eye and of 15 D in the other. The acuteness of the better eye was only $\frac{1}{3^{0}}$ Snellen. Yet this lad had no idea that there was anything wrong with his eyes.

Some of the facts connected with concomitant convergent squint may be adduced quite appropriately in this connexion. Take a person with this form of strabismus and a high degree of amblyopia in the squinting eye. If by accident the good one is lost, such a patient is nevertheless often able to do a great amount of work, and that even when the form sense of the squinting eye does not materially improve.

In conclusion, I wish to mention an experiment which I have recently made. I placed a lad with excellent visual acuteness at 5 metres from the ordinary types invented by Snellen for the measurement of the form sense. One of his eyes was kept covered, and with the other he followed my finger as it moved along the wall on which the types were suspended at the level of the largest letter—that is, of the letter corresponding to $\frac{5}{6^{0}}$ of the usual scale. So soon as the finger was taken to a distance of 14 cm. from the types, he was quite unable to make out the form of that letter which should be seen by a healthy eye, such as his, at 60 metres on direct fixation. The retina at a small distance from the macular region, as is well known, has practically no form sense.

In the case of this lad, the form of this comparatively large object was not recognized when the angle between the visual axis and the line joining the object with the eye was approximately one degree. The same lad was then stood before a table which was covered with white paper, and was given a small black mark as a fixation point. A sixpenny-piece was put on the table at such a distance outwards from the point of fixation that the angle between the visual axis and a line joining the coin with the eye was about 45°. It was then found that when he kept steadily looking at the black mark he was able to bring down his clenched fist without any hesitation or difficulty on the top of the coin. This he did again and again without once missing it.

Before long I hope to make a series of experiments on the same subject with the view of determining limits; any one, however, can perform the experiment for himself. It seems to go a long way to prove my original proposition that for many kinds of work the form sense, commonly called the visual acuteness, does not appreciably come into play at all. In these cases it is a question of alignment, for which the ordinary light sense of the retina appears to be amply sufficient.

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